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(54) Title: BIOCONVERSION OF XYLAN AND LEVULINIC ACID TO BIODEGRADABLE THERMOPLASTICS

(57) Abstract: Biodegradable polyesters are produced by microbial fermentation using xylose and levulinic acid as carbon sources.

WO 2004/027076

management problems, and continued global pollution. Another marketable advantage of these biopolymers is their production from renewable resources used as the primary carbon source and co-substrate. Production based on relatively inexpensive substrates could make PHA-derived thermoplastics more economically competitive with petroleum-based plastics, as the major costs in PHA production are the substrate and the separation process (Byrom 1987). Ramsay *et al.* (1995) demonstrated the ability of *Pseudomonas pseudoflava* to produce poly- $\beta$ -hydroxyalkanoates using the major sugars present in hemicellulose as sole carbon sources. Naylor *et al.*, U.S. 5,871,980, disclose production of PHA by fermentation of *Alcaligenes sp.* by feeding the cells an aliphatic acid typically containing one or more alkyl groups containing 8-25 carbon atoms. Naylor *et al.* demonstrate that optional addition of an odd-number carbon molecule, e.g., propionic acid or n-propyl alcohol, can result in the production of PHAs containing up to 30 mol% valerate.

Levulinic acid is a 4-keto-pentanoic acid obtainable via acid hydrolysis of 6-carbon sugars, which can be derived from carbohydrate-containing renewable wastestream residues (Bozell *et al.* 2000). Co-polymers of P(3HB-co-3HV) have been produced microbially (*Alcaligenes sp.* SH-69) from glucose and levulinic acid, with this organic acid co-substrate displaying a significant stimulatory effect on both cell growth and co-polymer accumulation (Jang and Rogers 1996). Jang and Rogers (1996) report that levulinic acid is an inexpensive substrate that compares favorably with propionic, valeric, or pentanoic acids as a co-substrate for PHA production. Steinbuchel *et al.* (1998) describe the production and characterization of polyesters containing 4-hydroxyvaleric acid and medium-chain length hydroxyalkanoic acids from octanoic acid as a principal carbon source and levulinic acid as a co-substrate.